RECENT DEVELOPMENT AND IMPLEMENTATION OF WEIGH-IN-MOTION IN SOME ASIAN COUNTRIES

Chia-pei Chou
National Taiwan University
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Scope

- China
- Hong Kong
- Japan
- Malaysia
- South Korea
- Taiwan
- Thailand

China

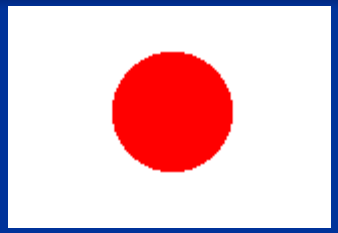
- Around 30 WIM sites.
- Enhance bridge safety.
- Pre-selection the suspicious overloaded vehicles.
- Some WIM sensors are embedded at 45 ° from the traffic direction to measure the Individual wheel load of dual wheels.
- The tolerance of vehicle weight can be up to +30% of the weight limits due to the extreme overloading situation.

Nanjing Second Bridge

- The 21km Nanjing second bridge was opened in 2000.
- 2 HSWIMs were installed ahead of the bridge.
- High-speed pre-selection.
- Photos of overloading vehicles are transmitted to the downstream LS WIM.
- Information is shown on the overhead CMS.
- The vehicle is required to enter the ramp to the second LSWIM.
- Detailed checking is proceeded.

Hong Kong

- 2 WIMs were installed:
  - Tsing Ma Bridge in 1997.
  - Ting-Kau Bridge in 1998.
- Bending plate WIM.
- Bridge management
- CMS provides information to overloading vehicles.
- Highway patrols guide the vehicles to the static weight station.

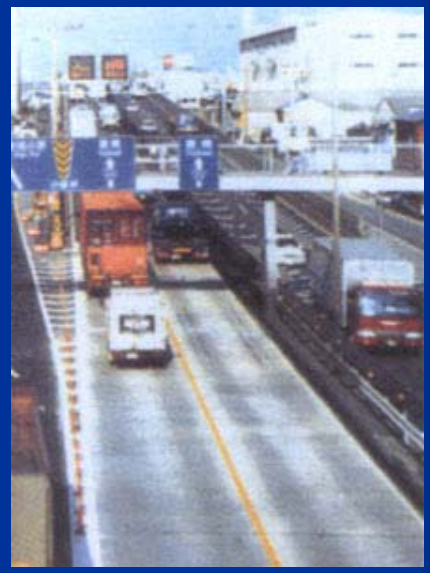


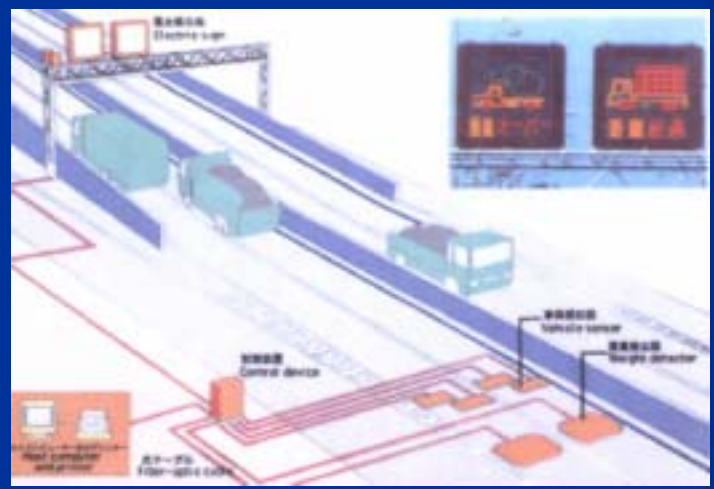
Japan

- Both high speed and portable low speed types were introduced and implemented for various purposes.
- Imported WIMs and domestic manufacture products have been used in several occasions.
- Nagoya Weigh-in-Motion System
- Automated Measuring System for Specially Permitted vehicles

Nagoya City: Weigh-in-Motion System

- Installed on National Route 23 by the Chubu Regional Construction Bureau.
- Measures and processes the weight of each vehicle at a rate of approximately 0.5 second.
- The system will be upgraded to 0.3 ton on each measuring axle at a running speed up to 80 km/hr.





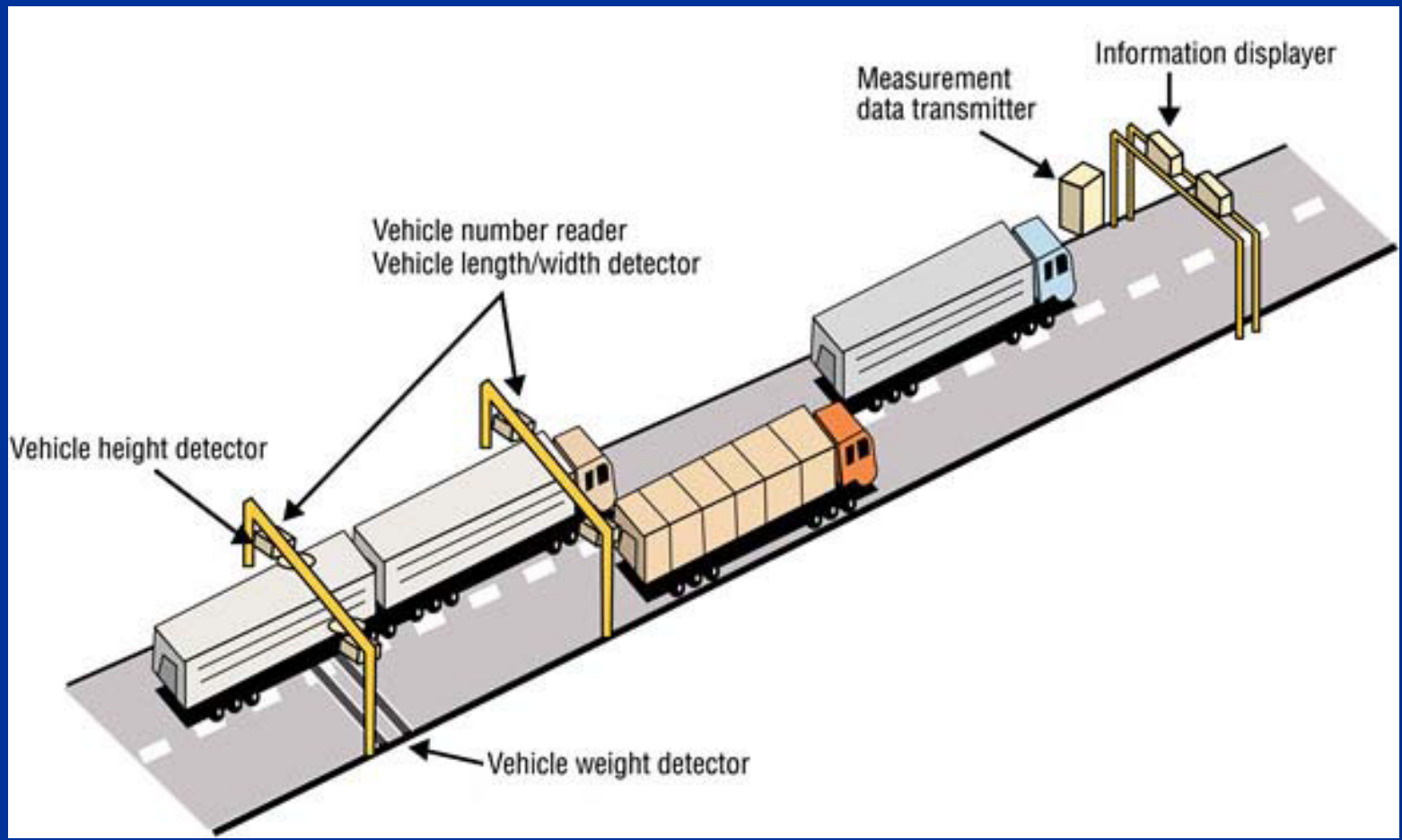
Automated Measuring System for Specially Permitted vehicles in Osaka

- National Route 1 at Hirakata, Osaka.
- Measure vehicle weight and size, and detect the license plate number.
- License plate of vehicles violating the weight limits will be shown on the display board.

Automated Measuring System for Specially Permitted vehicles in Kobe

- National Highway No. 43 in November 1997
- Detect vehicles violate Cabinet Order on vehicle restriction and give a warning through a CMS.
- A database, stores measured data at each site and transmitted to the control office in real time, was introduced in 2001.
- The measured data are analyzed, and warning is given to the owners and drivers of vehicles that repeatedly violate the rules.

Automated Measuring System for Specially Permitted vehicles in Kobe

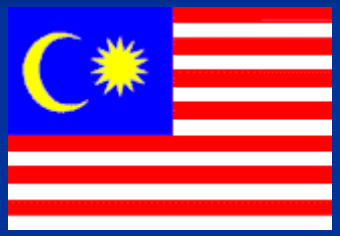


Malaysia

- 44 enforcement stations
- Constructed between 1992~1998.
  - Phase 1: 92-94, 24 stations
  - Phase 2: 94-98, 20 stations
- All equipped with LSWIM.
- 32 equipped with HSWIM.
- 42 at Federal Road. (Level 2 highway)
- 2 at privatized expressway.
- No enforcement station at the 850km privatized North-South expressway.

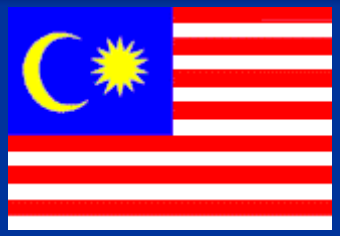
Responsible Authorities

- Construction
  - International tender called by Malaysia Ministry of Works
- Operation
  - Under Malaysia Ministry of Transport
  - Undertaken by Enforcement Division of the Road Transport Department (JPJ)
- Maintenance
  - JPJ contracts out service & maintenance of the system to local companies.
  - Inspect monthly.
  - Re-calibrate half-yearly.



HSWIM Overview (1)

- Installed at 500-700m upstream and downstream of each station
- No written specification for HSWIM, accuracy of ± 15% is considered adequate.
- 26 piezo sensor systems
- 38 bending plate systems



HSWIM Overview (2)

- Piezo Sensors
  - Trevor Deakin Consultants of UK.
  - Suspended since 2000 due to maintenance budget constraints.
  - Resume operation after upgrading the electronic control units in 2003.
- Bending Plates
  - PAT of Germany.
  - Removed in 2000.
  - Plan to re-instrument these sites in 2003.

System Overview - LSWIM

- Supplied by TDC UK (25) and PAT Germany (19)
- Electronic control units and software in all 44 stations were upgraded to Y2K compliance version by FEISCO in 1999.
- System accuracy: ± 2% compared with a full-size weighbridge

Results and Future Moves

- Percentages of overloaded trucks has dropped from 48% in 1998 to 36% in 2001.
- JPJ recognizes the benefits of the system.
- JPJ will construct 15 new stations in the next 5 years.
- 26 stations will be constructed at the privatized roads within 5 years.

South Korea

- 4 pre-selection sites of overloaded control were constructed in 1998.
- 49 traffic monitoring systems were constructed on national roads from 1999 to 2000.
- 1 bridge overloading control pre-selection sites, equipped with license plate recognition, was installed in June 2001.

Pre-Selection Sites

- Supplied by ECM of France
- Piezoelectric sensors
- Measured weight accuracy: Class B(10)
- One site is equipped with license plate recognition software.
- Transmits video image towards the control terminal if:
  - straddles the solid line
  - exceeds the authorized load limits.

- Variable or fixed message sign is activated to ask the driver to enter the enforcement weighing site.
- Charged overloaded vehicles increased 75% more after implementing the system

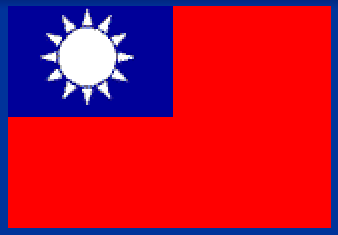
Traffic Monitoring System

- Supplied by FESICO of Malaysia
- Piezo sensors manufactured by TDC of UK.
- Collect real time traffic information (volume & speed)
- Connected with Freeway Traffic Management System
- Measured weight accuracy: ± 7%

Bridge Overloading Pre-Selection System

- Piezo sensors manufactured by TDC of UK.
- Prevent overloaded vehicles passing over a bridge.
- License number is identified by recognition system.
- Information displayed on a variable message sign to indicate the driver to divert away from the bridge.

- Measured weight accuracy: ± 10%



Taiwan

- WIM was introduced in the early 90s.
- High speed and portable low speed WIMs were both used.
- HSWIM for direct enforcement
- Portable LSWIM for law enforcement
- HSWIM for statistical data collection
- Freeway pre-selection HSWIM

HSWIM for direct enforcement

- Provincial Highway (PH) No.1 and No. 145 in 1991.
- Infrared camera takes photos of heavily overloaded vehicles.
- PAT bending plate WIM.
- Accuracy: ±8%
- Threshold of overloading is legal weight +20%.
- Vehicle's GVW above the threshold will be cited directly.

Portable LSWIM for law enforcement

- 150 sets of portable LSWIM purchased by highway police in 2000.
- System accuracy:
  - 10% for wheel load
  - 5% for GVW
- System suspended since June 2001 due to the implementation of “weight-based” overloading fine structure.

Portable HSWIM for statistical data collection

- National Taiwan University conducts heavy vehicle weight studies since early 90s.
- Capacitance WIM
- The accuracy :
  10% to 15% for GVW
- Revision of overloading fine structure was based on the research findings.

Permanent HSWIM for statistical data collection

- PAT bending plate WIM.
- 4 lanes (2 directions) system installed at the west coast expressway
- Accuracy: ±8%
- Operated by The Highway Bureau since 2001

Freeway pre-selection HSWIM

- HSWIM was installed in the entrance ramp of static weigh station for pre-selection purpose at south section of NF3 in 2000.
- WIM data are transferred to weigh house and the vehicle's legal weight limit is identified by WIM.
- Red light will show at roadside and the driver is asked to enter the static weigh scale.

Freeway pre-selection HSWIM

OK

NG

Static
Weigh scale

Thailand

- The highway protection system against vehicle overloading was installed in Bangkok in Jan. 2002.
- Overloaded or over-height vehicles were detected by TDC LO-TRAC axle weighbridge system.
- Divert them away form the highway.

Conclusions

- Use WIM for vehicle weight data collection, pre-screening, and direct law enforcement is the tendency in Asian countries in the twenty-first century.